EFFECTS OF ACCLIMATION ON THE SURVIVAL OF SPRING CHINOOK SALMON 8903000

SHORT DESCRIPTION:
Provide Klickitat River acclimation water to the Klickitat Hatchery. Construct the facilities required, then rear and release four brood years of spring chinook under various rearing conditions.

SPONSOR/CONTRACTOR: WDFW
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SUB-CONTRACTORS:
NA

GOALS

GENERAL:
Increases run sizes or populations, Adaptive management (research or M&E)

ANADROMOUS FISH:
Research, M&E

NPPC PROGRAM MEASURE:
No response

RELATION TO MEASURE:
Columbia Basin Fish and Wildlife Programs-Sections 206(b)(1), 206(b)(1)(C), 206 (e)Measures 206(b)(4), 703(e)(1) and (2). The Hatchery Effectiveness Technical Work Group identified 10 major priorities, the first of which was this project. These plans were approved by the Council in January 1988 per Measure 206 (b)(4). This project responds to Measure 703 (e)(1) and (2) which concerned improvement of fish propagation at existing facilities.

TARGET STOCK	LIFE STAGE	MGMT CODE (see below)
Results applicable to all populations in basin	Smolt	S,A,N,W,
Spring Chinook	Smolts	A,W

AFFECTED STOCK	BENEFIT OR DETRIMENT
Other anadromous fish populations using the Columbia Ri.	Beneficial

BACKGROUND

Stream name:
Klickitat River

Subbasin:
Klickitat River

HISTORY:
FY89: OBJECTIVE 1: Provide Klickitat River acclimation water to the Klickitat Hatchery. This was done in two phases. Phase 1 developed an Engineering Feasibility Study, pre-design development, and contract documents. Cost was $39,991; FY90: Phase 2 of Objective 1 was begun during this year. The construction contract was advertised, awarded and construction began. All required permits (water rights, shorelines, and SEPA) were obtained during this year. An operations and maintenance budget for FY 91 of $66,709 was approved during this year. Objective 2: Secure adequate brood Klickitat spring chinook to fulfill study requirements was begun this year. FY91: Objective 1, phase 2, was complete during this year. Total cost for construction was $729,886. The 1989 brood spring chinook (first group) were released in May 1991 (Objective 3). An operations and maintenance budget for FY92 of $71,333 was approved during this year. Additionally, continuation of Objectives 2 (Secure brood), Objective 3 (tagging and releasing fish), and Objective 5 (Data analysis and reports) occurred this year. FY92: Minor additions were made to the 12 study ponds this year. Spring chinook were tagged and reared according to study specifics. The

1990 brood spring chinook (second group) was released in May 1992 (Objective 3). An operations and maintenance budget for FY93 of $66,833 was approved during this year. Additionally, continuation of Objectives 2 (Secure brood), Objective 3 (tagging and releasing fish), and Objective 5 (Data analysis and reports) occurred this year. FY93: Spring chinook were tagged and reared according to study specifics. The 1991 brood spring chinook (third group) was released in May 1993 (Objective 3). An operations and maintenance budget for FY94 of $58,925 ($68,925-$10,00 carry over) was approved during this year. Additionally, Objectives 2 (Secure brood) was complete this year. Work on Objective 3 (tagging and releasing fish), and Objective 4 (collection of coded-wire tags) and Objective 5 (Data analysis and reports) occurred this year. FY94: Spring chinook were tagged and reared according to study specifics. The 1992 brood spring chinook (fourth and last group) was released in May 1994 (Completing Objective 3; Tagging and release of study groups). An operations and maintenance budget for FY95 of $39,995 was submitted during this year. Work on Objective 4: Recovery of coded-wire tagged returning adults continued this year. Recoveries from coast wide fisheries and escapement to Klickitat hatchery are being collected and analyzed. Work on Objective 5 (data and Reports) continued this year. FY95: An operations and maintenance budget for FY96 of $36,802 was submitted during this year (slightly below original budget estimates). Work on Objective 4: Recovery of coded-wire tagged returning adults and Objective 5 (data and Reports) continued. FY96: An operations and maintenance budget for FY97 of $34,401 was submitted during this year (slightly below original budget estimates). Work on Objective 4: Recovery of coded-wire tagged returning adults and Objective 5 (data and Reports) continued. Two treatment groups plus a control group are involved in this experiment. One group was reared using only ground water (control and normal practice at Klickitat). The second group was exposed to Klickitat River water for 3 weeks prior to release. The third groups was exposed to Klickitat river water for 6 weeks prior to releases. All groups were coded-wire tagged. The returns of tagged fish from catch and escapement are being analyzed to determine if there are significant survival advantages (smolt to adult) from exposing fish to ambient river water prior to release. All broods of juvenile fish have been tagged and released. Remaining work for FY97/FY98 include collection of coded-wire tagged fish in the ocean fisheries, tribal in-river fisheries and as escapement.

BIOLOGICAL RESULTS ACHIEVED:

All study objectives have/are being achieved. In each of 4 years, 240,000 Klickitat spring chinook were reared and released as designed. All biological sampling of juveniles was successfully carried out (gill ATp-ase, smolt status observations, bacterial kidney disease screening). Since 1992, adults and jacks have been recovered at Klickitat Hatchery and in various fisheries, the coded-wire tags recovered and data collected and reported on.

PROJECT REPORTS AND PAPERS:

To date, 6 annual and 18 quarterly reports have been submitted to BPA concerning this project. In addition, an oral presentation was given at the BPA projects review meeting in Vancouver, WA in 1993.

ADAPTIVE MANAGEMENT IMPLICATIONS:

The Columbia basin fish and Wildlife Program Section 203 (a) proposes and interim goal of doubling the runs of salmon and steelhead in the Columbia Basin. As part of this effort, Section 206 (b)(1) (C) creates areas of emphasis where BPA is to focus its funding of salmon and steelhead research, which includes exploring methods for substantially increasing and improving hatchery production at existing hatcheries within the next 10 years. Subsequently, the Hatchery Effectiveness Technical Work Group identified 10 major priorities, the first of which was this project. These plans were approved by the Council in January 1988 per Measure 206 (b)(4). This project responds to Measure 703 (e)(1) and (2) which concerned improvement of fish propagation at existing facilities.If the results prove a benefit to smolt-to-adult survival, these results could make current and future mitigation efforts more effective throughout the basin. Additionally, one advantage of rearing fish on ambient river water is speculated to be an increase in smoltification. If this proves to be true, this should reduce travel time during downstream migration and reduce inter- and intra-specific competition. Recovery Plans: The recovery plan for the Columbia River may utilize information generated from this project. Additionally, the Integrated Hatchery Operations Team (IHOT) when developing or amending policies affecting hatcheries in the Columbia River Basin will review the results of this work when formulating recommendations for rearing standards within the basin. Biological Opinions: Based on the Biological Opinion of 1993, permit number 829 was issued to WDF under the authority of the Endangered Species Act. A major concern of the Section 7 consultations and Section 10 considerations revolved around interactions between hatchery and naturally produced salmonids. Reducing interactions between both juvenile downstream migrants and returning adults is considered very important. Results of this research will apply to both questions.

PURPOSE AND METHODS

SPECIFIC MEASUREABLE OBJECTIVES:
In FY98 additional adult returns will be collected at the hatchery and from the coast wide catch via the Pacific States Marine Fisheries Commission (PSMFC) coded-wire tag data retrieval system. This will allow the completion of Objective 4 (collection of coded-wire tagged adults) and 5 (data analysis and reports). I'm absolutely certain of being able to attain these objectives.

CRITICAL UNCERTAINTIES:
Currently, there remains one critical uncertainty, that is funding for Klickitat hatchery operations. If NMFS (through Mitchell Act) funding is withdrawn from Klickitat Hatchery, the final 2 years of data collection will be lost. This will weaken the power of the statistical analysis in the study.

BIOLOGICAL NEED:
If the hypothesis that overall survival can be increased by pre-release acclimation proves to be true, several benefits will accrue. First, an increase in total catch and escapement can be expected with no increase in the hatchery production level. An incremental gain will be made toward the Council's goal of doubling runs entering the Columbia River. Broodstock status of klickitat spring chinook will be improved, benefiting the Council's Yakima/Klickitat Enhancement Plan. Finally, a technique will be demonstrated that can be applied at other hatcheries and release sites with similar water supply arrangements.

HYPOTHESIS TO BE TESTED:
The hypothesis remains unchanged from the original study proposal. The question remains whether fish reared on ground water have better smolt-to-adult survival than fish acclimated to ambient river water prior to release. The number of replicates in the project and the number of brood years will make the statistical test very robust. See original project study proposal for full details.

ALTERNATIVE APPROACHES:
A survey of all available facilities on the Columbia River with Spring Chinook rearing was conducted prior to beginning this work. Klickitat hatchery provided the best combination of facilities for this work.

JUSTIFICATION FOR PLANNING:
NA

METHODS:
GOAL: To determine if acclimation of spring chinook smolts in ambient temperature surface water prior to release will increase survival (smolts-to-adults) compared to smolts raised only on constant temperature spring water. Objective 1: Provide Klickitat River acclimation water to the Klickitat hatchery site: Objectives 2,3,4: Compare the performance (survival to adults) of spring chinook smolts raised in and released directly from a groundwater supplied hatchery to smolts released from the same hatchery following acclimation with the ambient tributary receiving water for a period of time before release. Objective 5: Data Analysis and Reporting (Quarterly and Yearling Progress Reports) The basic experimental design is a two-factor, years and treatments, analysis of variance with a third component, ponds, regard as randomized blocks. For each of four years, there was two treatments, 3-week and 6-week pre-release acclimation, plus a control. Four ponds were randomly assigned to each of these levels and 20,000 Klickitat spring chinook reared in each pond (240,000 total per year). All fish in each pond were tagged with pond specific CWT (4 ponds per treatment).

PLANNED ACTIVITIES

SCHEDULE:

Planning Phase	**Start** 1989	**End** 1990	**Subcontractor**	
Task Complete 1990				
Implementation Phase	**Start** 1990	**End** 1994	**Subcontractor**	
Task All elements completed by 1994				

O&M Phase **Start** 1995 **End** Sept 98 **Subcontractor**

Task FY 98: An operations and maintenance budget for FY98 of $37,204 will be submitted during this year (slightly below original budget estimates). Work on Objective 4: Recovery of coded-wire tagged returning adults and Objective 5 (data and Reports) will be completed.

PROJECT COMPLETION DATE:
1998

CONSTRAINTS OR FACTORS THAT MAY CAUSE SCHEDULE OR BUDGET CHANGES:
None identified.

OUTCOMES, MONITORING AND EVALUATION

SUMMARY OF EXPECTED OUTCOMES

Expected performance of target population or quality change in land area affected:
As this is a research project, the results will be analyzed objectively and the results will be applied as appropriate. If survival to adulthood is enhanced by rearing on ambient water, a number of facilities within basin (and the region) may begin altering their rearing capabilities to include this type of treatment.

Present utilization and convservation potential of target population or area:
Current utilization potential is low for ocean fisheries, high for in-river tribal net fisheries. Also, there is good potential for in-river sport fisheries as well. Conservation potential for target stock (Klickitat spring chinook) is good. More importantly is the effect this technique could have on all other populations in the basin. Improving smolt to adult survivals can have far reaching implications for many projects and programs throughout the basin. Utilization can be increased and or reduced competition can be realized by releasing fewer smotls from existing facilities.

Assumed historic status of utilization and conservation potential:
Same as above, one goal would be to return to historic levels of utilization while improving health of listed populations by reducing competition with hatchery production.

Long term expected utilization and conservation potential for target population or habitat:
Same as above. High interest in increasing the utilization potential for tribal fisheries above Bonneville Dam (Zone 6). This projects relates directly to that goal.

Indirect biological or environmental changes:
By increasing smolt to adult survivals, either more adults or the same number of adults can be produced with fewer smolts released. Both of these strategies have important implications to increasing utilization (more adults) and reducing competition with listed stocks that use the Columbia River during early rearing.

Physical products:
240,000 spring chinook were tagged for 4 consecutive years. Adults are being collect through 1998.

Environmental attributes affected by the project:
NA

Changes assumed or expected for affected environmental attributes:
NA

Measure of attribute changes:

NA

Assessment of effects on project outcomes of critical uncertainty:
Because only one years remains in the project, critical uncertainties will not pay a significant role in the outcome. (See above for critical uncertainties)

Information products:
Products are a series of smolt to adult survival estimates for Klickitat spring chinook reared under different conditions. These will be compared to determine the most effective rearing method.

MONITORING APPROACH
The number of adults returning from the various different rearing conditions can easily be monitored either through annual reports for the project or verified by retrieving data from the PSMFC data base of Coded Wire Tag Recoveries.

Provisions to monitor population status or habitat quality:
As long as Klickitat Hatchery continues to operate (as it has since 1955) the population will be continuously monitored.

Data analysis and evaluation:
The basic experimental design is a two-factor, years and treatments, analysis of variance with a third component, ponds, regard as randomized blocks. For each of four years, there was two treatments, 3-week and 6-week pre-release acclimation, plus a control. Four ponds were randomly assigned to each of these levels and 20,000 Klickitat spring chinook reared in each pond (240,000 total per year). All fish in each pond were tagged with pond specific CWT (4 ponds per treatment).

Information feed back to management decisions:
Objective 5: Data Analysis and Reporting (Quarterly and Yearling Progress Reports)

Critical uncertainties affecting project's outcomes:
Do to the advanced state of this project, no critical uncertainties remain that could cause the failure of this project to be completed.

EVALUATION
The number of adults returning from the various different rearing conditions can easily be monitored either through annual reports for the project or verified by retrieving data from the PSMFC data base of Coded Wire Tag Recoveries.

Incorporating new information regarding uncertainties:
See above on project uncertainties

Increasing public awareness of F&W activities:
Increases in smolt to adult survival could increase the utilization component for both treaty net fishers and river sport fishers. This will have a positive impact on the regions awareness of BPA's efforts in the basin.

RELATIONSHIPS

RELATED BPA PROJECT	RELATIONSHIP
4) Missing Production Groups- Washington Hatcheries.	Projected contributed significant statistical power to groups tagged and released from Klickitat(due to replication).
3) Monitoring Environmental Conditions in the Lower Columbia River.	Project contributed significant controlled data (through adult survival estimates) to evaluation of Lower Columbia Ri.
2) Evaluation of Fish Quality Indices.	Project contributed significant controlled research data (due to replication) to this project.

1) Columbia Basin Fish and Wildlife Programs-Sections 206(b)(1), 206(b)(1)(C), 206 (e)Measures 206(b)(4), 703(e)(1) and (2).

Project was identified as first priority for research in 1988 by NWPPC (Hatchery Advisory Group) as having significant positive effects on numerous populations within the basin.

RELATED NON-BPA PROJECT	RELATIONSHIP
Columbia River Fisheries Development Program	Project contributed significant controlled data (through adult survival estimates) to evaluation of hatcheries on the Lower Columbia Ri.

OPPORTUNITIES FOR COOPERATION:
The Yakima Indian Tribe and Columbia River Inter-Tribal Fish Commission are interested parties due to the effect increase smolt-to-adult survival rates would have on Zone 6 and Klickitat River harvest. Currently they have been requested to increase in-river fisheries sampling to assist in the recovery of coded-wire tags. They have not responded to this request.

COSTS AND FTE

1997 Planned: $36,100

FUTURE FUNDING NEEDS:

FY	$ NEED	% PLAN	% IMPLEMENT	% O AND M
1998	$37,204		100%	

PAST OBLIGATIONS (incl. 1997 if done):

FY	OBLIGATED
1989	$511,329
1990	$242,611
1991	$113,988
1992	$66,826
1993	$64,815
1994	$22,728
1995	$34,401
1996	$42,191
TOTAL:	$1,098,889

Note: Data are past obligations, or amounts committed by year, not amounts billed. Does not include data for related projects.

FY	OTHER FUNDING SOURCE	AMOUNT	IN-KIND VALUE
1998	WDFW		$4,000 (Computer time)

OTHER NON-FINANCIAL SUPPORTERS:
NA

LONGER TERM COSTS: NA

1997 OVERHEAD PERCENT: 19%

HOW DOES PERCENTAGE APPLY TO DIRECT COSTS:
Applies to direct total cost.

CONTRACTOR FTE: 2

SUBCONTRACTOR FTE: NA